Alaska Space Grant Program
University of Alaska Fairbanks
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The **Alaska Space Grant Program** is a Program Grant Consortium funded at a level of **$660,000** for fiscal year 2010.

PROGRAM GOALS

Outcome 1: Contribute to the Development of the STEM Workforce (Employ and Educate)

Diversity:

Goal: Encourage participation of female and underrepresented minority students and faculty in Alaska Space Grants Programs.

Objectives:

1. Work to engage our minority population at the Affiliate institutions through American Indian Science and Engineering Society (AISES), Alaska Native Science and Engineering Program (ANSEP) and our Affiliate representatives. Add at least one additional minority fellowship/scholarship application per year until we reach or exceed our stated minority goal.
2. Expand our affiliate organization to include the minority serving rural campuses within the UA system and Ilisagvik College, Barrow, AK. Add one new minority affiliate/year until all Higher Ed campuses in Alaska are represented.
3. Recruit at our rural campuses for summer fellowships to NASA and to our main campus's. Obtain at least one minority student application from a rural campus/year.

Fellowship:/Scholarship Program:

Goal: Provide a program that supports workforce development by pumping the STEM "pipeline" through offering a sequence of competitive scholarship (to engage students early in their career) and fellowship (to provide "authentic" research and engineering experiences) opportunities to Alaskan students from diverse populations in STEM, and related education disciplines at Affiliate member institutions. Fellowship/scholarships will be provided equitably across the state with an emphasis on achieving and maintaining diversity in numbers of applicants and awardees.

Objectives:

1. Recruit at least one applicant per year for an internship or summer program at a NASA center. By 2011 recruit at least one applicant per 4 yr affiliate institution per year.
2. By spring 2011 the "Student Opportunities in Alaska" webpage connecting students to NASA "relevant" research projects and faculty will identify opportunities at every 4 yr institution.
3. Each year, at least one early career scholarship will be awarded at each affiliate institution to a freshman, sophomore or a student transitioning from a rural campus to a 4 yr degree program.
4. Every year, at least one fellowship will be awarded at each affiliate institution that has a 4 yr STEM degree program or to a rural student performing summer research at an affiliate 4 yr degree institution.
5. At least one additional fellowship/scholarship will be awarded per year to an appropriate minority applicant until we reach or exceed our stated minority goal.
6. In academic year 2010-11, award two graduate student fellowships partnering the graduate student with a NASA researcher.

Research Infrastructure Program:

Goal: Provide research initiation grants in strategic areas to improve collaboration between Alaska and NASA researchers and to improve the ability of Alaskan researchers to compete for NASA research and development work.

Objectives:

1. At each Affiliate institution identify and support expertise in areas of interest to NASA. By 2012 at least one strategic area of interest will be identified at every Affiliate institution with a 4 year STEM degree program.
2. Build capacity and expertise in the aerospace program at UAF to successfully respond to NSF and NASA solicitations for small satellite missions. By 2012 a small satellite proposal will be submitted.
3. Provide a venue for researchers across the state to meet and develop inter-institutional collaborations. The Alaska Space Grant first annual symposium will be held in May 2010. At least one collaborative research infrastructure project will be awarded by 2012.
4. In academic year 2010-11, facilitate the collaboration between a NASA scientist and an Alaska scientist which leads to a submitted proposal in support of NASA related research.

Higher Education Program:

Goal: Provide support for interdisciplinary team activities and events that act to synthesis a student's degree program and connect students to NASA higher education programs. Provide support for curriculum development/modification for the inclusion of NASA relevant topics.

Objectives:

1. By 2012 create an "Alaska Space Grant Grand Challenge" competition with teams at each of our rural affiliate institutions to provide "authentic" research and/or engineering experiences on our minority serving campuses.
2. In 2010, Alaska Space Grant will host their first annual symposium where students may present their research projects. In 2010, 50% of all students receiving fellowship awards or participating in Alaska Space Grant supported higher education activities will present their work either at the Alaska Space Grant Symposium or at some other professional conference. By 2015 over 90% of these students will be presenting their work.
3. Promote NASA higher education programs at our affiliate institutions. At least one student or team will participate in a NASA higher education program every year.

4. Continue to support NASA relevant Higher Education programs at each Affiliate institution that contribute to the overall employment rate in STEM fields. 90% of all students participating in Higher Education programs will continue to graduate school, a career in STEM field, or pre-college teacher training.
5. In academic year 2010-11, conduct a faculty curriculum development workshop to establish a foundation for laboratory-based STEM courses that are offered by distance delivery to rural campuses. Generate a "best-practices" handbook by December 2010.
6. In academic year 2010-11, develop and deliver at least one STEM laboratory-based course whose enrollment includes students from a rural campus.

Outcome 2: Attract and Retain Students in STEM Disciplines (Educate and Engage)

Precollege Program:

Goal: Provide support for Alaska pre-college STEM education with emphases on NASA content, teacher training, and delivery to underrepresented group.

Objectives:

1. Increase the STEM content knowledge of Alaska's pre-college teachers through teacher professional development. All ASGP sponsored professional development programs will show increased STEM content knowledge.
2. Support rural teacher professional development with summer programs and/or distance delivery programs. At least one professional development project/class targeting rural teachers will be supported each year.
3. Support standards based curriculum development in STEM fields connecting NASA relevant materials to the classroom. All curricula will be standards based and be freely available through the ASGP and/or our affiliate's website.
4. Provide limited support for student involvement activities to inspire interest in STEM fields and careers that specifically target underrepresented students. Each student involvement activity will show increased interest in pursuing STEM education and/or careers.
5. In AY10-11 work with NASA to develop and deliver an engineering summer camp for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers. Pilot the engineering summer camp in 2011 targeting 25 students.
6. Engage secondary school teachers through teacher professional development program in the development and delivery of both an engineering summer camp and smaller modules appropriate to classroom. Target 10 teacher participants of which 50% will present modules in their classroom in the subsequent year.

Outcome 3: Build strategic partnerships and linkages between STEM formal and informal education providers (Engage and Inspire)

Informal Education Program

Goal: Provide support for professional development of informal education providers and informal education programs that use NASA themes and content and/or Alaska Native "ways of knowing" to enhance participant awareness and knowledge of NASA mission activities, STEM disciplines and career opportunities.

Objectives:

1. Connect informal education providers to NASA relevant research conducted in Alaska through the Alaska Space Grant Symposium to collaboratively develop Alaska/NASA specific informal education programs and professional development opportunities. Identify at least one new informal education activity each year.

2. Facilitate at least one annual training session to equip informal science educators with the knowledge and skills needed to deliver NASA aerospace content that will effectively engage large numbers of participants.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, OR 3)

Outcome 1

- Continued increase of funded underrepresented minority students in our fellowship/scholarship program to 32% (FY10) from 16.7% (FY09) and 8% (FY08). We have 15 applicants to NASA summer academy/internships. Scholarship applications come from every affiliate academic institution including one from a Alaska Native serving campus.
- Two distance courses are currently under development.
- Mindy Krzykowski, a senior majoring in Physics at UAF, won the Best Poster award for her presentation at the recent Conference for Undergraduate Women in Physics in Lincoln Nebraska. Mindy's presentation, "Identifying and characterizing VxB events from the Suprathermal Ion Detector Experiment (SIDE) of the Apollo 14 Mission", resulted from her work last summer (2010) in the Lunar and Planetary Science Academy at NASA Goddard Space Flight Center. Mindy continues to work with her Goddard mentor during the academic year to further her research in will be returning to Goddard in the Summer of 2011.
- Three papers were presented at the UAF Mechanical Engineering masters student Wyatt Hurlbut presented a paper at the 2010 Thermal and Fluids Analysis Workshop (TFAWS): (1) "Thermal Science Results of the Ionospheric Science and Inertial Sensing (ISIS) Sounding Rocket Payload", presented by Tess Caswell, former ME student from UAF presenting thermal data obtain from the student payload launched in 2009; (2) "A Passive Thermal Analysis of a Small Satellite", presented by Wyatt Hurlbut, ME graduate student at UAF; (3) "Enhancement of the Performance of Thermal Control Systems Using Nanofluids", presented by Deben Das, ME faculty at UAF.

Outcome 2:

- Presented short-term teacher professional development in robotics. Impact about 20 teachers in Fairbanks and the Interior.
- Developed and presented hands-on STEM curriculum to support home-school community.

Outcome 3:

- Presented results on incorporating Alaska Native stories into planetarium presentations at the 2010 Association of Science and Technology Centers (ASTC) 2010 annual meeting. Participation in a round table discussion about general strategies for bringing astronomy and other STEM content to traditionally underserved audiences.
- Two affiliate representatives attended a National and/or Western Regional Space Grant Directors meeting.

PROGRAM ACCOMPLISHMENTS

Outcome 1: Contribute to the Development of the STEM Workforce (Employ and Educate)

Diversity: Increased minority applications to Fellowship/Scholarship program. Awarded 50% minority in Scholarships, 21% minority in Fellowships. Added new minority serving affiliate College of Rural and Community Development.

Fellowship:/Scholarship Program: 16 applicants to NASA summer internship/academies (all from UAF). Awarded, fellowships 26 applications (APU, UAF), 19 awards, 58% female, 21% minority, scholarships 37 applications (all institutions), 12 awarded (all institutions, 1 to CRCD), 58% female, 50% minority, 3 graduate fellowships (UAF, 1 full, 2 half), 100% male non-minority. Cumulative rate of awards to underrepresented minorities in FY2010 is 29% (compared to 16.7% in FY09 and 8% in FY08).

Research Infrastructure: Two funded research infrastructure awards in FY10 at UAF. Proposals for FY11 funding come from UAA, UAF, and CRCD. 2nd annual Space Grant Symposium will be held in Anchorage and will combine research talks from Alaska NASA EPSCoR awardees. Partnered with NASA Goddard and NASA JSC for design reviews of the Alaska Research CubeSat.

Higher Education: APU, UAS, and UAF each conduct hands-on authentic research and/or engineering experiences that include NASA relevant topics through space grant funded higher education projects. The statistics for the longitudinally tracked students for FY10 is not available until the end of May 2011. Conducted a higher education workshop, "Distance Delivery of Laboratory Based Science Courses for Students in Alaska", which brought together science faculty from CRCD rural campuses with science faculty at the UAF Fairbanks campus and the Center for Distance Education, to discuss issues of access of science/engineering curriculum at the rural campuses and engagement of distance students. Two freshman courses are currently in development to be provided to distance students.

Outcome 2: Attract and Retain Students in STEM Disciplines (Educate and Engage)

Precollege Program: Supported afterschool programs in robotics at a title 1 elementary school and high school. Supported teacher professional development in robotics in a two day workshop in Fairbanks and in two rural communities in interior Alaska. Currently developing a summer summer residential engineering camp with teacher professional development. The pilot will be conducted in the summer 2011. Supported science curriculum development and implementation for home school community in Kenai.

Outcome 3: Build strategic partnerships and linkages between STEM formal and informal education providers (Engage and Inspire)

Informal Education Program: Supported travel to attend the Association of Science and Technology Centers (ASTC) 2010 annual meeting to present results of recent work on incorporating Alaska Native stories into planetarium presentations, and participation in a round table discussion about general strategies for bringing astronomy and other STEM content to traditionally underserved audiences. Two affiliate representatives attended a National and/or Western Regional Space Grant Directors meeting.

NASA 2010 Education Priorities

Authentic, hands-on student experiences: APU, UAS, UAF, and CRCD each conduct hands-on authentic research and/or engineering experiences that include NASA relevant topics through space grant funded higher education projects.

Glaciology Field Experience for Undergraduates (UAS): provided support for students to participate in a summer semester glaciology field course on the Juneau Ice Field. This field

course provides meaningful, on-ice research experience for undergraduates in the physical sciences, who are seeking careers in the earth, environmental, and climate sciences. Students collect annual glacier mass balance, summer surface ice velocities, and summer meteorological data from sites across the ~1700 km^2 Ice Field's temperate glaciers located in the Northern Cordilleran region of southern coastal Alaska. This data complements remotely sensed information collected for this region by NASA's suite of satellites in the Earth Observing Program.

Space Systems Engineering Program (UAF): provides interdisciplinary students with hands-on experience in all aspects of space systems engineering through a design, build, launch paradigm applied to balloon and rocket payloads and small satellites. The current project is the Alaska Research CubeSat (ARC). We have proposed and were selected for an Educational Launch of Nanosats (ELaNa) mission. We have a tentative launch date of March 2013. Over the past two years much design work has already occurred. In December 2010, we conducted our Preliminary Design Review (PDR). This design review was chaired by Jeff Volosin of Goddard Space Flight Center. The design review was attended locally by two Goddard engineers and over 6 other engineers through teleconference from Goddard, Johnson Space Center, and McMurdo Station, Antarctica. We are currently addressing the Requests for Action from that review.

Use of Radio Telescopes in an Undergraduate Environmental Science Curriculum (APU): incorporates the use of a Very Small Radio Telescope (VSRT) to observe the 11 GHz line of ozone in the mesosphere, as well as introduce students to the basic principles of remote sensing through construction and use of the small radio telescope. Ozone observations will be conducted in conjunction with the Mesospheric Ozone System for Atmospheric Investigations (MOSAIC) project operated by Haystack Observatory and MIT. A MOSAIC site was established on the Alaska Pacific University (APU) campus in September and we have collected ozone measurements continuously since then. Formal learning activities will be developed to make use of APU's ozone spectrometer and the MOSAIC network. The second aspect of the project will enable student teams to construct very small radio telescopes and use these in performing a variety of experiments. This modified environmental sciences course will be presented in fall 2010.

Higher Ed STEM Training with an Ocean Observation System (CRCD- Kuskokwim Campus): (new course development) This curriculum development proposal will serve as a proof of concept demonstrating that ocean exploration can be used to develop some of the same skills and aptitudes important for space exploration. A marine autonomous recording unit will be deployed for three months on the ocean bottom near a system of ocean passes in the Andreanof Islands. College students early in their education will be trained to use computer software programs that perform automated search functions. They will use this software to systematically search hours of recordings and locate cetacean vocalizations. They will program pattern recognition software to accomplish this task, and then they will measure acoustical properties of the vocalizations. They will then analyze these data sets to determine the species of cetaceans present, the times and duration of their occurrence, the relative intensities of their signals, and inferences regarding their behaviors. Students will learn how the same technology and analytical skills are employed in Earth and space observations. This project will help to attract and retain rural Alaskan and native Alaskan college students in STEM disciplines.

Engage middle school teachers in hands-on curriculum enhancement:
SeaPerch Training for Teachers in Interior Alaska: This project was collaborative with Juneau Economic Development Council. Robert Parsons traveled to several rural villages to provide local robotics training for teachers and students. Additionally, a two day workshop was held for Extended Learning Program (ELP) teachers in the Fairbanks school district to provide training in SeaPerch, an underwater robotics program
Engineering Sandbox Creating Alaska's (future) Professional Engineers: ESCAPE to Alaska: Engage secondary school teachers through teacher professional development program in the development and delivery of both a NASA style engineering summer camp and smaller modules appropriate to classroom. 2011 was the pilot year for this summer camp. During this pilot year 14 educators (in-service teachers, 4H leaders) participated in two modules geared towards exploring the development of a Mars habitat: (i) energy technologies and (ii) robotics.

Community Colleges: In 2010 ASGP welcomed a new affiliate, the College of Rural and Community Development, which acts as an umbrella institution for five Alaska Native minority serving rural campuses and one community campus in Fairbanks. CRCD is administratively housed within the UAF system and is therefore designated a 4-year college rather than a 2-year college.

Environmental Science and Global Climate Change: Four of the six research infrastructure mini-grants awarded (see below) and three of the four higher education mini-grants awarded (see list above under Authentic, hands-on student experiences) address aspects of environmental science and global climate change.

Diversity of institutions, faculty, and student participants: With the inclusion of CRCD as an affiliate, ASGP includes all major campuses in Alaska (APU, UAA, UAF, UAS) plus five Alaska native serving campus (CRCD). We now have programs from Juneau to Nome. We have achieved gender diversity (50% female) of PI's in our mini-grant awards and gender (48.9% female) and ethnic (23.4% minority) diversity in our student fellowship/scholarship awards.

Enhance capacity of institutions to support innovative research infrastructure: Awarded six research initiation mini-grants to faculty at UAF, UAA, and CRCD.

1. *Degradation Behaviors of Fiber Reinforced Polymer Composite Materials in Extreme Environments for Aerospace Applications,* PI: Jing Zhang, Assistant Professor, Mechanical Engineering, CEM, UAF
2. *Novel Method to Predict Hazard Zones of Airborne Volcanic Ash from Eruptions*, PI: Jifeng Peng, Assistant Professor, Mechanical Engineering, CEM, UAF
3. *Habitat and avian communities as indicators of environmental change in the boreal forest of interior Alaska*, PI: Abby Powell, Research Associate Professor, IAB, UAF
4. *"Follow the Water": Determination of Unfrozen Water Content and Mechanisms of its Survival in Soils of the Dry Valleys of Antarctica by Nuclear Magnetic Resonance*, PI: Liliya Vugmeyster, Assistant Professor, Chemistry, UAA
5. *Investigations of Interior Alaska Loess Sources: Reconstructing Quaternary Glacial/Interglacial Storms*, PI: Elisabeth Nadin, Assistant Professor, Ceology and Geophysics, UAF

6. *Time Series of Temperature and Salinity Profiles in the Coastal Ocean of the Northeastern Bering Sea*, PI: Hector Douglas, Assistant Professor, Biology, CRCD-Kuskokwim Campus

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Longitudinal Tracking:** Fellowship/Scholarship: total awards 34 (FY10) of which 22 are longitudinally tracked (12 awards were for one time scholarships). All of the 22 (FY10) longitudinally tracked students are currently in school, although 6 are expected to graduate and one already has a job offer in STEM (non-aerospace) field. More complete longitudinal tracking data will be available after the end of the semester. 32% of all fellowship/scholarship awards went to underrepresented minority students.
- **Course Development:** two courses are under revision to include distance students.
- **Matching Funds:** $480,000, 1:1 for non-fellowship funds**.**
- **Minority-Serving Institutions:** College of Rural and Community Development (CRCD) is an Alaska Native minority serving college within UAF, that acts as the umbrella College for multiple rural campuses. CRCD became a new affiliate of Alaska Space Grant in May of 2010. Throughout the 2010/2011 academic year the ASGP director held discussions with the CRCD affiliate director and CRCD math and science faculty on how to best participate in the ASGP programs. The CRCD math and science faculty participated in the ASGP sponsored higher education workshop, "Distance Delivery of Laboratory Based Science Courses for Students in Alaska".

IMPROVEMENTS MADE IN THE PAST YEAR

- Increased minority engagement. Targets met or exceeded in Fellowship and scholarship awards.
- Increased number of applicants to NASA summer academies/internships (16 for summer 2010)
- Added minority serving affiliate: College of Rural and Community Development
- Awarded scholarships at every affiliate institution
- Increased our engagement of middle school teachers in hands-on curriculum enhancements in robotics.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

- **University of Alaska Fairbanks (UAF)** – Lead institution, research center for the statewide university system, and only PhD granting institution in the state of Alaska. Participates in fellowship/scholarship, research infrastructure, higher education, and precollege programs.
- **University of Alaska Anchorage (UAA)** – urban 4-year University serving the population center of Alaska. Currently participates in fellowship/scholarship programs.
- **University of Alaska Southeast (UAS)** – regional 4-year University serving southeast Alaska. Participates in fellowship/scholarship, and higher education programs
- **Alaska Pacific University (APU)** – Private 4-year University focusing on inquiry based learning in environmental sciences. Participates in fellowship/scholarship and higher education projects.
- **College of Rural and Community Development** – community college serving Alaska Native students in rural Alaska. Participates in fellowship/scholarship program. New affiliate.

- **Challenger Learning Center of Alaska** – non-profit corporation focusing on hands-on precollege science programs.
- **Anchorage Museum** – Focuses on hands-on exhibits and inquiry-based programs in Space and Earth Science and Aerospace technology.
- **Juneau Economic Development Council (JEDC)** – non-profit corporation supporting K12 STEM education programs. New affiliate this year.